**Lesson 3 Astronomy Notes Outer Planets**

**Jupiter**

Jupiter, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in our solar system, commands attention with its immense size and striking features.

Located \_\_\_\_\_\_\_\_\_\_\_\_ from the Sun, this gas giant is a captivating celestial entity that has fascinated astronomers and space enthusiasts for centuries.

Jupiter belongs to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_category, along with Saturn, and is primarily composed of hydrogen and helium.

Unlike terrestrial planets, Jupiter lacks a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, and its atmosphere extends deep into its interior.

Jupiter's colossal size is evident in its diameter, which is approximately \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ that of Earth.

Despite its size, Jupiter's rapid rotation gives it a day length of about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

The immense mass of Jupiter exerts a powerful\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, influencing the orbits of nearby celestial bodies.

Its gravitational pull plays a crucial role in the stability of the solar system.

Jupiter boasts a remarkable collection of moons, with over \_\_\_\_\_\_ confirmed natural satellites.

The four largest moons—\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, known as the Galilean moons—have diverse characteristics, including volcanic activity and subsurface oceans.

Although not as prominent as Saturn's rings, Jupiter possesses a faint ring system composed of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_particles.

These rings, discovered by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_spacecraft, contribute to the planet's overall celestial allure.

1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

Pioneer 10 and 11 were the first spacecraft to provide close-up images of Jupiter in the 1970s, offering valuable insights into the planet's atmosphere.

1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

The Voyager 1 and 2 missions conducted extensive studies of Jupiter in the late 1970s, capturing detailed images and data about its atmosphere, moons, and rings.

1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

The Galileo spacecraft, launched in 1989, orbited Jupiter for almost eight years, providing in-depth observations of the planet and its diverse moons.

**Saturn**

Saturn, the \_\_\_\_\_\_\_\_\_\_\_\_\_ planet from the Sun, is a breathtaking spectacle with its iconic ring system.

Saturn's rings are of icy particles ranging in size from tiny grains to large chunks.

Like Jupiter, Saturn is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_primarily composed of hydrogen and helium.

It lacks a solid surface, and its atmosphere, though similar to Jupiter's, exhibits unique features such as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_cloud patterns at its north pole.

Saturn is the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_planet, dwarfed only by Jupiter, with a diameter approximately nine times that of Earth.

Despite its immense size, Saturn's\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, indicating a composition of mostly lightweight gases.

Saturn's rotation period is slightly over \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, making it one of the fastest-spinning planets in our solar system.

Saturn boasts an extensive family of moons, numbering over \_\_\_\_\_\_\_\_\_.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the largest moon, stands out with its thick atmosphere and lakes of liquid methane and ethane.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, a smaller moon of Saturn, has garnered attention for its geysers of water vapor and icy particles erupting from beneath its surface.

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * The Pioneer 11 and Voyager 1 and 2 missions provided the first close-up views of Saturn, capturing detailed images of its rings and moons in the late 1970s and early 1980s.
2. ­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
   * Launched in 1997, the Cassini spacecraft orbited Saturn for 13 years, delivering a wealth of data on the planet, its rings, and its moons.
   * The Huygens probe, part of the mission, successfully landed on Titan, providing valuable insights into the moon's composition.

**Uranus**

Uranus, the \_\_\_\_\_\_\_\_\_\_\_\_\_planet from the Sun, stands out because of its axial tilt.

The extreme axial tilt of Uranus means that it experiences extreme seasonal variations as different poles face the Sun during its \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

This unusual rotation and a rapid day length of approximately 17 hours makes Uranus unique.

Uranus possesses a system of \_\_\_\_\_\_\_\_\_, though they are faint compared to the prominent rings of Saturn.

The rings of Uranus were discovered in 1977, and recent observations have revealed more details about their composition and structure.

Uranus has a diverse array of moons, with \_\_\_\_\_ known natural satellites.

Notable moons include Titania, Oberon, Miranda, Ariel, and Umbriel, each exhibiting unique geological features and characteristics.

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The Voyager 2 spacecraft conducted the only close flyby of Uranus in 1986, providing the first detailed observations of the planet, its rings, and its moons.

Uranus emits more \_\_\_\_\_\_\_\_ than it receives from the Sun, indicating the presence of an internal heat source.

The exact nature of this heat, whether from leftover primordial heat or ongoing ­­­­­­­­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, remains a topic of scientific investigation.

**Neptune**

Neptune, the \_\_\_\_\_\_\_\_\_\_\_\_and farthest planet from the Sun, is a distant and enigmatic giant in our solar system.

Neptune, like its neighbor Uranus, is classified as an \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, composed mainly of hydrogen, helium, water, methane, and ammonia.

Neptune's average distance from the Sun is about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, making its orbit approximately \_\_\_\_\_\_\_ Earth years long.

Its slow orbit contributes to the planet's chilly temperatures, with an average surface temperature of -353 degrees Fahrenheit (-214 degrees Celsius).

Despite its distant orbit, Neptune has a surprisingly rapid rotation, completing a day in just about \_\_\_\_\_\_ hours.

Neptune possesses a faint ring system, discovered in 1984 by the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

\_\_\_\_\_\_\_\_\_\_\_\_, Neptune's largest moon, stands out with its retrograde orbit, moving opposite to the planet's rotation.

This unusual orbit suggests that Triton may have been captured by ­­­­­­­­­­­\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, leading to speculation about its origins.

The Voyager 2 spacecraft provided humanity's only close-up observations of Neptune in 1989.

**Pluto**

In 2006, the International Astronomical Union (IAU) redefined the criteria for classifying objects as planets, leading to Pluto's reclassification.

1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
   * One of the three criteria for a celestial body to be considered a planet is that it must orbit the Sun. Pluto meets this criterion, as it orbits the Sun.
2. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
   * The second criterion requires a celestial body to have sufficient mass for its self-gravity to overcome rigid body forces, allowing it to assume a nearly round shape. Pluto satisfies this condition, as it is spherical in shape.
3. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**
   * The third criterion is where Pluto falls short. A planet, according to the IAU definition, must "clear its orbit" of other debris. Pluto shares its orbit with other small objects in the Kuiper Belt, a region beyond Neptune populated by numerous icy bodies. Since Pluto does not dominate its orbital zone, it fails to meet this criterion.

Due to its inability to clear its orbit of other debris, Pluto was reclassified as a "dwarf planet" rather than a full-fledged planet.